Contribution ID: **117** Type: **contributed talk**

Relativistic Jet of Markarian 421: Observational Evidences of Particle Acceleration Mechanisms

Wednesday, 10 July 2019 10:45 (15 minutes)

Markarian 421 is one the most extreme blazars characterized by complex, unpredictable timing/spectral variability, exclusively strong X-ray flares in some epochs, very broad, nonthermal spectral energy distribution (SED) extending over 19 orders of the frequency and showing a typical two-"hump" structure. The lower-energy component, ranging from the radio to X-rays, is widely accepted to be a synchrotron radiation emitted by ultra-relativistic electrons/positrons/protons, while the origin of higher-energy emission (the MeV-TeV range) still remains controversial (synchrotron self-Compton, external Compton, hadronic etc.). All these mechanisms need the presence of highly-relativistic particles in the jet, to be initially accelerated via the Blandford-Znajek mechanism and magneto-hydrodynamic processes in the vicinity of the central supermassive black hole. However, particles loose the energy, sufficient for emitting the KeV photons, very quickly and the source can maintain its flaring state on the daily-weekly timescales if some additional acceleration mechanisms are continuously at work. According to different studies and simulations, the particles can gain a tremendous energy due to the propagation of relativistic shocks through the jet: by means of first-order Fermi mechanism at the shock front, or they undergo an efficient stochastic (second-order Fermi) acceleration close to the shock, in the turbulent jet medium. Our intense X-ray spectral study of Mrk 421 has revealed the dominance of these processes in different epochs: while the spectral curvature and photon index show a positive cross-correlation during some flares (expected in the framework of energy-dependent acceleration probability scenario: a particular case of first-order Fermi mechanism), other epochs clearly demonstrate the observables of the stochastic (second-order Fermi) acceleration (low spectral curvature; anti-correlation between the spectral curvature and the position of the synchrotron SED peak). During several X-ray flares, the source also showed hard power-law spectra, expected in the case of relativistic magnetic reconnection.

Primary author: KAPANADZE, Bidzina (Ilia State University)

Presenter: KAPANADZE, Bidzina (Ilia State University)

Session Classification: Particle acceleration and Radiation processes

Track Classification: Particle acceleration and Radiation processes